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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PS 1347 for a patent by SPATTER SHIELD (AUST) PTY LTD as filed on 26 March 2002.

WITNESS my hand this
Twenty-ninth day of September 2004

J. Billingsley

JULIE BILLINGSLEY
<u>TEAM LEADER EXAMINATION</u>
<u>SUPPORT AND SALES</u>

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PROVISIONAL SPECIFICATION

Invention Title: CONTROL DEVICE FOR DISPERSING A SPATTER RETARDANT IN A SHIELDING GAS FOR ARC WELDING

Applicant: SPATTER SHIELD (AUST) PTY LTD

The invention is described in the following statement:

CONTROL DEVICE FOR DISPERSING A SPATTER RETARDANT IN A SHIELDING GAS FOR ARC WELDING

Field of the Invention

The present invention relates generally to any arc welding process that utilizes a shielding gas, and particularly to devices and apparatus for entraining a spatter retardant liquid in that shielding gas.

Background of the Invention

In arc welding there have long been problems associated with the generation of small and minute pieces of metal, commonly called "spatter", within and about the outlet end of a welding torch, and also about the weld and weld piece. Conventionally, a welding operator is required to physically remove such spatter, which is often a physically demanding task sometimes requiring more than one operator, and which also introduces downtime.

Various attempts have been made to design heads and/or nozzles for welding torches that are capable of removing or reducing the spatter problem. Attempts have also been made to develop chemical coatings that may be applied directly to the weld torch and/or the weld-piece to prevent the spatter from attaching too rigidly thereto.

One attempt to reduce the spatter problem has been described in the applicant's own United States patent 5,603,854 where a system is described that disperses a liquid spatter retardant into the inert gas of an arc welding process. Whilst this system successfully reduces the effects of spatter, it does not readily allow for the volume of entrained liquid to be adjusted, as might be necessary when the system is used for a variety of different types of arc welding.

In this respect, some types of arc welding (such as hydrogen controlled welding) are often used to create welds that must be rated to high pressures, such as in the fabrication of pressure vessels. These welds must meet reasonably stringent requirements in relation to the hydrogen content in the welds, in order to minimize the likelihood of cracks and/or fractures.

Therefore, for a particular welding activity where there are the dual aims of achieving a reduction in spatter yet also achieving low levels of hydrogen (indicated by low diffusible hydrogen levels in the weld), it is important that any spatter reduction system be able to be controlled so as to adjust the spatter retardant levels.

With this in mind, as a part of the development process that lead to the present invention, the present inventors recognized that an increase in spatter retardant levels in the shielding gas of particular arc welding processes (which is desirable, in order to reduce spatter) appeared to result in undesirable increases in levels of diffusible hydrogen in the welds. The inventors thus recognized the need to be able to, in some situations, control such spatter retardant levels, in order to satisfy maximize spatter retardant effects yet minimize diffusible hydrogen levels.

An aim of the present invention is thus to provide a control device capable of being used in the dispersing of a spatter retardant in a shielding gas used for arc welding. Following from that, the present invention also aims to provide a suitable dispersion apparatus that utilises the control device.

<u>Summary of the Invention</u>

The present invention provides a control device for use with dispersion apparatus capable of dispersing a spatter retardant in a gas to form a mist for use as a shielding gas in arc welding, the dispersion apparatus including a

chamber having a retardant-containing portion and a mist-containing portion, the control device including:

- a gas inlet in fluid communication with a gas outlet, the gas outlet being such that, in use, it is within the retardant-containing portion of the chamber; and
- a mist outlet capable of being, in use, in fluid communication with the mist-containing portion of the chamber;

wherein the gas outlet includes means for controlling the flow of gas therefrom such that, in use, the ratio of gas to retardant in the mist can be controlled.

The present invention also provides a dispersion apparatus that utilises the control device. The present invention thus provides an apparatus for dispersing a spatter retardant in a gas to form a mist for use as a shielding gas in arc welding, the apparatus including:

- a chamber having a retardant-containing portion and a mist-containing portion;
- a gas inlet in fluid communication with a gas outlet, the gas outlet being within the retardant-containing portion of the chamber; and
- a mist outlet in fluid communication with the mist-containing portion of the chamber;

wherein the gas outlet includes means for controlling the flow of gas therefrom such that the ratio of gas to retardant in the mist can be controlled.

The present invention further provides welding apparatus that utilises the dispersion apparatus having the control device. The present invention thus provides an apparatus for arc welding, the apparatus including means for supplying a gas, a dispersion apparatus having a control device as described above for dispersing a spatter retardant in the gas to form a mist for use as a shielding gas, means for delivering the shielding gas to a workpiece, means for delivering filler metal to the workpiece, and an electric arc welder.

Finally, and as will be further described bellow, the present invention also provides for a method of arc welding using a dispersion apparatus having a control device as described above, together with a method of reducing the effect of spatter during arc welding using a dispersion apparatus having a control device as described above.

General Description of the Invention

The dispersion apparatus with which the control device of the present invention is preferably used will ideally will be provided by a canister or the like, which provides a chamber having the retardant-containing portion and the mist-containing portion, together with a suitable support means and suitable in-line connections. In this respect, suitable in-line connections will preferably be such as to allow the dispersion apparatus to be installed within the shielding gas line in an existing welding operation, and will usually cooperate with (or be integral with) the gas inlet and the mist outlet described above as a part of the control device per se.

The canister thus acts as the source of the spatter retardant. In one form, the canister operates batch-wise, and may be refilled or replaced once the supply of spatter retardant is exhausted. In another form, the canister may be adapted to receive a continuous supply of spatter retardant, as necessary.

The canister may itself be an integral unit, unable to be opened without damaging the unit, or may be configured so as to be openable by the user or manufacturer. It may thus be provided as a lidded container, with the lid possibly being integral with, and thus forming a part of, the control device. Indeed, various elements of the control device may be advantageously provided as a part of a lid for the canister.

In one form of the invention, a filter may be provided between the retardant-containing portion and the mist-containing portion of the canister. Such a fliter

may simply be provided to prevent the generation of gaseous bubbles in the mist-containing portion, that may result in undesirable amounts of liquid moving through the mist outlet to the workpiece, as opposed to the controlled and reasonably finely dispersed liquid droplets that are formed in the mist. However, such a filter may itself also play in controlling the size and number of those liquid droplets.

In a preferred form, the gas outlet of the control device incorporates the means for controlling the flow of gas. In its simplest form, the gas outlet is a nozzle that is capable of adjustment to permit differing flowrates and/or pressures of gas therefrom. Preferably, the nozzle can be adjusted and set to provide a determined flowrate and/or pressure. In this way, the control device may be set by the manufacturer in advance of its use, or may be continuously adjusted by a user for each welding operation.

Preferably, the nozzle is provided at the free end of a probe that extends through the mist-containing portion of the chamber, through the filter (if present), and into the retardant-containing portion, such that the gas exits therefrom at or towards the bottom of the chamber.

In another preferred form of the present invention, there may be provided two fluid paths for the flow of gas, one representing a by-pass condition and the other representing an operational condition. Ideally, a triggering means is provided to move between the two conditions, such that the at rest position for the triggering means results in the operational condition being engaged. Thus, the triggering means must be manually manipulated in order to initiate the by-pass condition.

It will be appreciated that the gas may be any suitable shielding gas, and may be an inert gas, an active gas, or a combination of inert gas and active gas. In particular, the shielding gas may be argon or an argon based mixture, carbon dioxide, oxygen, helium, hydrogen, or a mixture thereof.

Further, the spatter retardant may be any suitable spatter retardant, and may for instance be one or more suitable hydrocarbons, such as petroleum distillate.

Further still, the types of welding processes with which the present invention may find use are numerous, but will all be of the general type that is categorized as arc welding, namely fusion welding in which heat for welding is obtained from an electric arc or arcs.

For example, suitable types of arc welding would be manual and gravity metal arc welding, such as flux cored arc welding (FCAW), gas metal arc welding (GMAW), pulsed arc welding (PAW) and resistance welding. Examples of the more common gas metal arc welding (GMAW) are CO_2 welding, metal inert gas arc welding (MIG) and metal active gas arc welding (MAG). All of these welding techniques may be conducted either using robotic or hand operated welding equipment.

Brief Description of the Drawings

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a dispersion apparatus in accordance with an embodiment of the invention;

Figure 2 is a cut away half view of the apparatus shown in Figure 1; and

Figure 3 is a mid-line cross-sectional view of the apparatus shown in Figure 1.

Detailed Description of the Preferred Embodiment

Figure 1 illustrates a dispersion apparatus 10 capable of dispersing a spatter retardant in a gas to form a mist for use as a shielding gas when arc welding.

The apparatus 10 includes a canister 12 that has a lid 14 threadedly engaged thereto. As shown in Figure 2, mounted within a central aperture 16 of the lid 14 is a headpiece 18. The headpiece 18 includes a base 20, a middle body 22 and a top 24. Attached to the top 24 is a support bracket 26 by which the apparatus 10 can be mounted to a support structure (not shown).

The middle body 22 includes a gas inlet 28 and a mist outlet 30. A barb 28a, 30a is connected respectively to the gas inlet 28 and the mist outlet 30 to enable connection to respective flexible pipes.

The middle body 22 also includes a centrally located probe 32. As shown in Figures 2 and 3, the probe 32 is integral with the middle body 22 and extends into the canister 12. The probe 32 has a lower end 34 that includes a gas outlet incorporated with a gas flow controlling means, which together form a flow control device 36. The upper end 38 of the probe 32 opens into a bore 35. Positioned above the bore 35, and arranged for up and down movement within the headpiece 18, is a plunger 40. The plunger 40 has a top 42 that protrudes from the lid 14.

In this embodiment, the control device of the present invention includes the gas inlet 28, the mist outlet 30, and the gas outlet that generally includes the lower end 34 of the probe 32 with its flow control device 36. This is probably best envisaged as being that part of the apparatus that would remain if the canister 12, its lid 14, and the support bracket 26 were removed.

Returning to a more detailed description of the dispersion apparatus as a whole, the middle body 22 (and thus, in effect, the control device of the invention) is configured so that there are two different fluid paths for gas to flow therethrough, a first flow path that represents a by-pass condition (and thus is referred to as a by-pass path) and a second flow path that represents an operational condition (and thus is referred to as an operational path).

The by-pass path is configured so that gas entering the gas inlet 28 flows directly towards the mist outlet 30 without passing into the probe 32. The by-pass path is engaged when the top 42 of the plunger 40 is depressed so as to close off the upper end 38 of the probe 32 to the flow of gas.

In this respect, depression of the top 42 of the plunger 40 causes a plug portion 40a of the plunger 40 to move into the bore 35 and thereby close off the bore 35. Depression of the plunger 40 also causes an arm 45 that extends from the plunger 40 to press against, and thereby open, the spring biased ball valve 46. This enables gas to pass through the gas inlet 28, into contact with a ball valve 48 so as to open the valve 48, through a pathway 49 which extends behind the plug portion 40a of the plunger 40, through the spring biased ball valve 46 and out through the mist outlet 30.

The operational path through the middle body 22 is one that enables the gas to pass through the gas inlet 28, through the bore 35 and into the upper end 38 of the probe 32. The operational path will be engaged when the plunger 40 is not depressed.

When the operational path is engaged, gas enters the gas inlet 28, presses against the ball valve 48 to open the valve, passes through the bore 35, into the upper end 38 of the probe 32 and then flows down along the probe 32 towards the lower end 34 thereof. The gas then passes through the flow control device 36, out through the apertures 54 formed in a housing 55 of the flow control device 36 and into the chamber 56 defined by the canister 12 and the lid 14.

In use, the chamber 56 includes a retardant-containing portion (i.e. the lower portion of the chamber) and a mist-containing portion (i.e. the upper portion of the chamber). The lower portion of the chamber 56 contains, in use, a spatter retardant. When gas passes through the apertures 54 of the flow control device 36, the gas is dispersed through the spatter retardant. This results in a mist forming in the mist-containing portion (i.e. the upper portion) of the chamber 56.

The mist, which is a mixture of the gas and the spatter retardant (the spatter retardant being entrained in liquid droplets in the gas), flows through the mist channels 60, which are formed in the base 20 of the headpiece 18. Each mist channel 60 has an upper opening 62 that is in fluid communication with the mist outlet 30. The spring biased ball valve 46 prevents the mist from back flowing through the pathway 49.

Thus, it will be appreciated that when the apparatus 10 is in use and the plunger 40 is not depressed, the shielding gas exiting the mist outlet 30 will contain an amount of spatter retardant. As will be explained in more detail subsequently, the amount of spatter retardant contained in the shielding gas exiting the mist outlet 30 will depend on the configuration of the flow control device 36.

Mounted within the mist-containing portion of the chamber 56 is a pair of filter supports 100. Each filter support 100 is arranged to be able to seat a filter pad (not shown). The filter pads are arranged to filter the mist before it passes through the mist outlets 60. Preferably, the filter pads are present in order to prevent gas bubbles from forming in the mist-containing portion of the chamber 56. However, the filter pads may also be selected such that they impact on the size of the liquid droplets in the mist. Of course, filter pads need not be used at all.

In the illustrated embodiment of the present invention, the flow control device 36 includes the housing 55, a nut 68 and a control pin 70. The nut 68 is secured to the lower end 34 of the probe 32 in a manner whereby the housing 55 can be threadedly secured to the nut 68. The housing 55 includes an upper bore 55a and a lower bore 55b. The upper and lower bores 55a,55b are joined by a middle bore 55c which has a reduced diameter. When the housing 55 is secured to the nut 68, the lower end 34 of the probe 32 is located in the upper bore 55a. The control pin 70 is mounted in the lower bore 55b of the housing

55 so that a top end 70a can be arranged to extend into the middle bore 55c, and may extend into the upper bore 55a.

The control pin 70 is mounted within the housing 55 so that rotation of the control pin 70 in one direction drives the control pin 70 upwardly towards the upper bore 55a. This restricts the flow of gas into the lower bore 55b and consequently the flow of gas out through the apertures 54. Rotation of the control pin 70 in the opposite direction withdraws the control pin 70 away from the upper bore 55a so as to enable an increased flow of gas through the apertures 54.

By varying the position of the control pin 70 within the housing 55, the amount of gas passing into the lower bore 55b and through the apertures 54 can be altered so as to ultimately control the composition of the mist which is formed in the upper portion of the chamber 56.

The top end 70a of the control pin 70 may be shaped to vary the nature of the flow of the gas as it passes over the control pin 70 and flows into the lower bore 55b and out through the apertures 54. The amount of turbulence in the flow may be varied by virtue of the shape of the control pin 70 so as to vary the amount of spatter retardant in the resulting mist.

Having described one form of flow control device 36, it will be appreciated by those skilled in the art that the flow control device 36 may adopt different configurations.

Finally, the embodiment has been described by way of example only and modifications within the spirit and scope of the invention are anticipated.

The claims defining the invention are as follows:

1. A control device for use with dispersion apparatus capable of dispersing a spatter retardant in a gas to form a mist for use as a shielding gas in arc welding, the dispersion apparatus including a chamber having a retardant-containing portion and a mist-containing portion, the control device including:
   - a gas inlet in fluid communication with a gas outlet, the gas outlet being such that, in use, it is within the retardant-containing portion of the chamber; and
   - a mist outlet capable of being, in use, in fluid communication with the mist-containing portion of the chamber;

   wherein the gas outlet includes means for controlling the flow of gas therefrom such that, in use, the ratio of gas to retardant in the mist can be controlled.

2. A control device according to claim 1, wherein the gas outlet incorporates the means for controlling the flow of gas.

3. A control device according to claim 2, wherein the gas outlet is a nozzle that is capable of adjustment to provide a predetermined flowrate and/or pressure of gas.

4. A control device according to claim 3, wherein the nozzle is provided at the free end of a probe configured so as to, in use, extend through the mist-containing portion of the chamber into the retardant-containing portion, such that the gas exits therefrom at or towards the bottom of the chamber.

5. A control device according to claim 1, including two fluid paths for the flow of gas, one representing a by-pass condition and the other representing an operational condition.

6. A control device according to claim 5, wherein a triggering means is provided to move between the two conditions, such that the at-rest position for the triggering means results in the operational condition being engaged.

7. A control device according to claim 6, wherein the triggering means, when moved away from its at-rest position, in the by-pass condition prevents the passage of gas to the gas outlet but permits the passage of gas to the mist outlet.

8. A control device according to claim 7, wherein the triggering means is a plunger capable of external manual manipulation.

9. An apparatus for dispersing a spatter retardant in a gas to form a mist for use as a shielding gas in arc welding, the apparatus including:
   - a chamber having a retardant-containing portion and a mist-containing portion;
   - a gas inlet in fluid communication with a gas outlet, the gas outlet being within the retardant-containing portion of the chamber; and
   - a mist outlet in fluid communication with the mist-containing portion of the chamber;

   wherein the gas outlet includes means for controlling the flow of gas therefrom such that the ratio of gas to retardant in the mist can be controlled.

10. An apparatus according to claim 9, wherein the chamber is defined by a canister.

11. An apparatus according to claim 9 or claim 10, wherein a filter is provided between the retardant-containing portion and the mist-containing portion.

12. A control device according to claim 9 wherein the gas outlet incorporates the means for controlling the flow of gas.

13. A control device according to claim 12, wherein the gas outlet is a nozzle that is capable of adjustment to provide a predetermined flowrate and/or pressure of gas.

14. A control device according to claim 13 wherein the nozzle is provided at the free end of a probe configured so as to, in use, extend through the mist-containing portion of the chamber into the retardant-containing portion, such that the gas exits therefrom at or towards the bottom of the chamber.

15. A control device according to claim 9, including two fluid paths for the flow of gas, one representing a by-pass condition and the other representing an operational condition.

16. A control device according to claim 15, wherein a triggering means is provided to move between the two conditions, such that the at-rest position for the triggering means results in the operational condition being engaged.

17. A control device according to claim 16, wherein the triggering means, when moved away from its at-rest position, in the by-pass condition prevents the passage of gas to the gas outlet but permits the passage of gas to the mist outlet.

18. A control device according to claim 17, wherein the triggering means is a plunger capable of external manual manipulation.

19. An apparatus for arc welding, the apparatus including means for supplying a gas, a dispersion apparatus having a control device according to any

one of claims 1 to 8 for dispersing a spatter retardant in the gas to form a mist for use as a shielding gas, means for delivering the shielding gas to a workpiece, means for delivering filler metal to the workpiece, and an electric arc welder.

20. A control device according to claim 1 substantially as herein described in relation to the accompanying drawings.

21. A dispersion apparatus according to claim 9 substantially as herein described in relation to the accompanying drawings.

22. An arc welding apparatus according to claim 19 substantially as herein described in relation to the accompanying drawings.

PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
SPATTER SHIELD (AUST) PTY LTD

26 March 2002

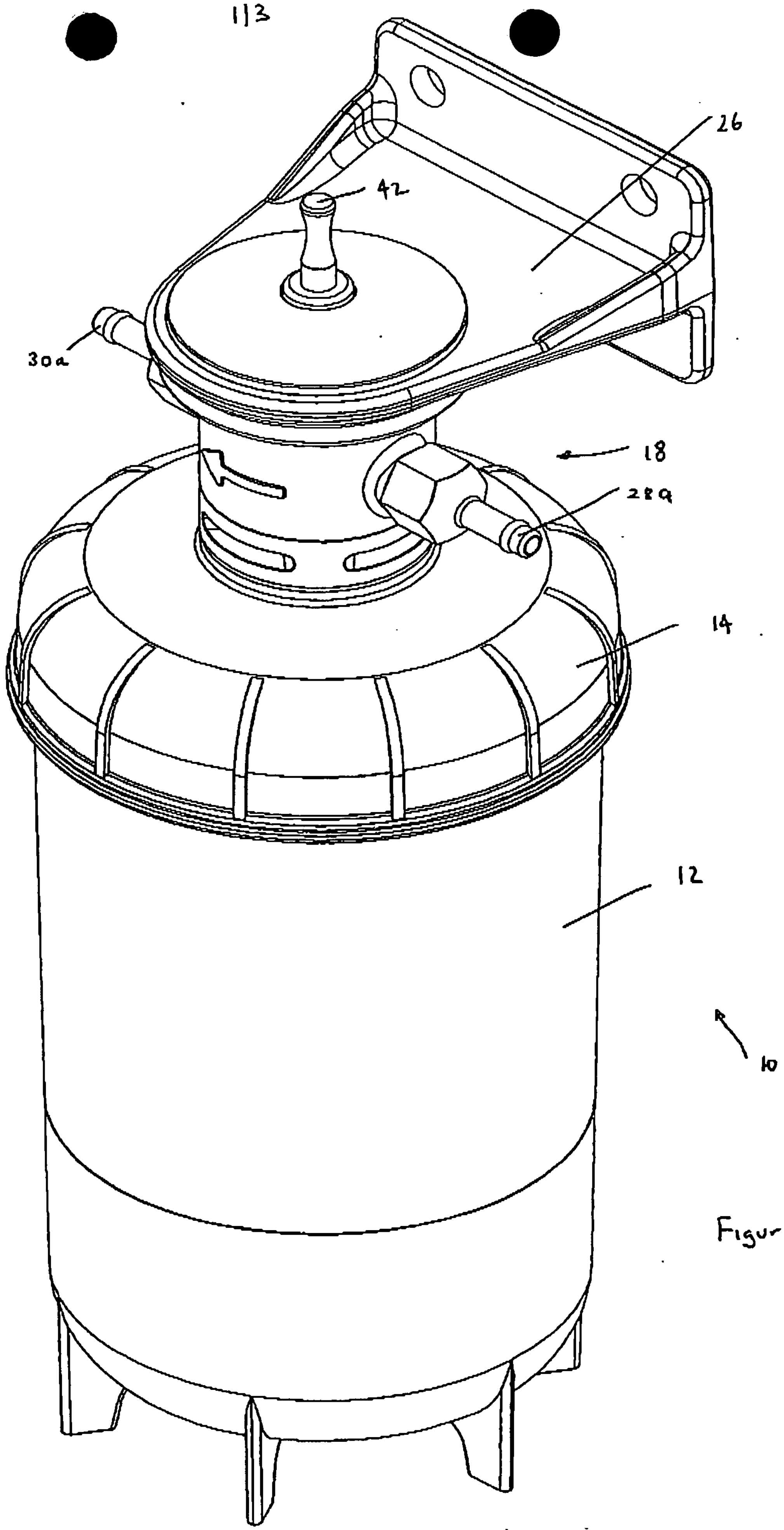

Figure 1

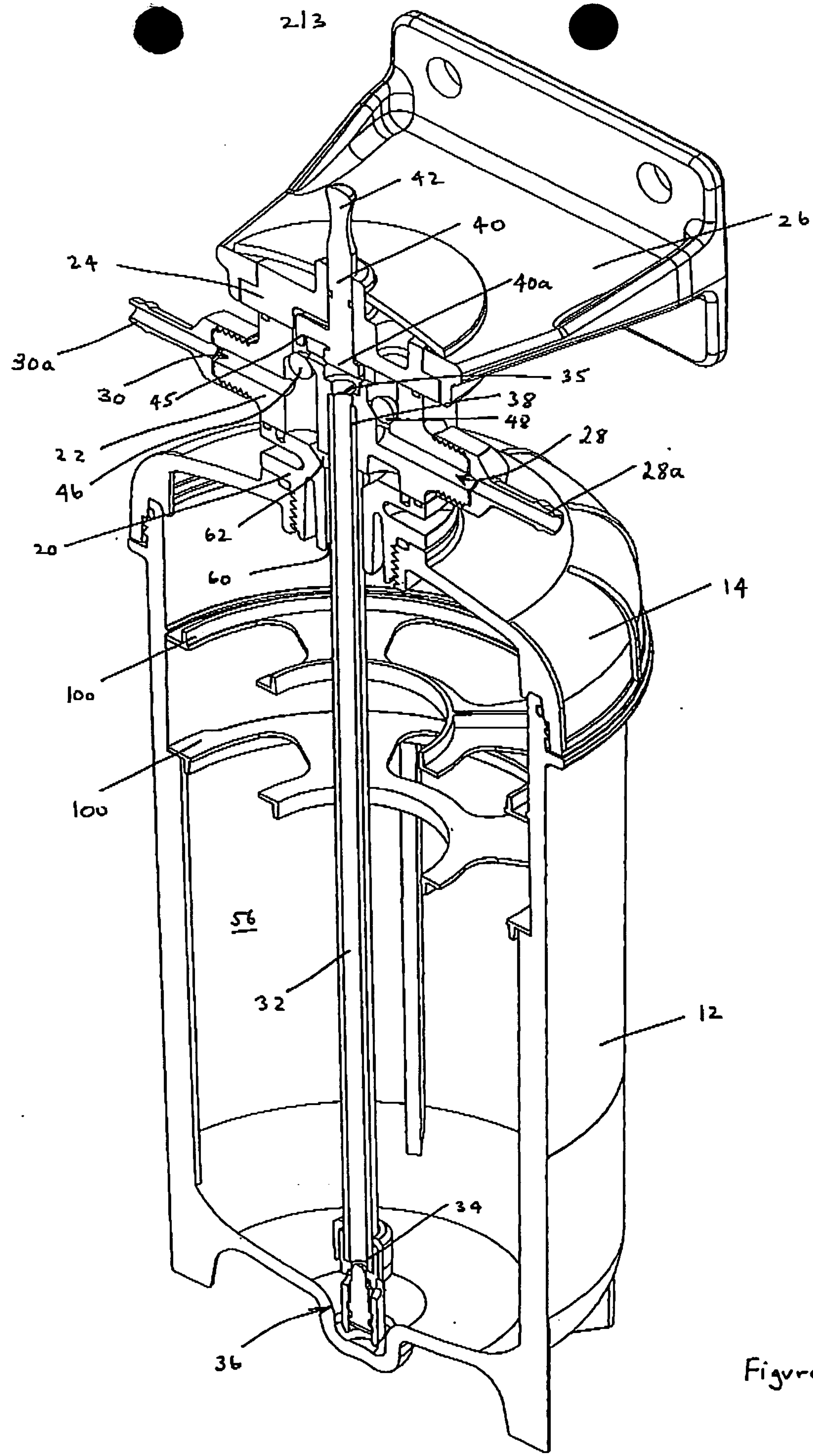
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Figure 2

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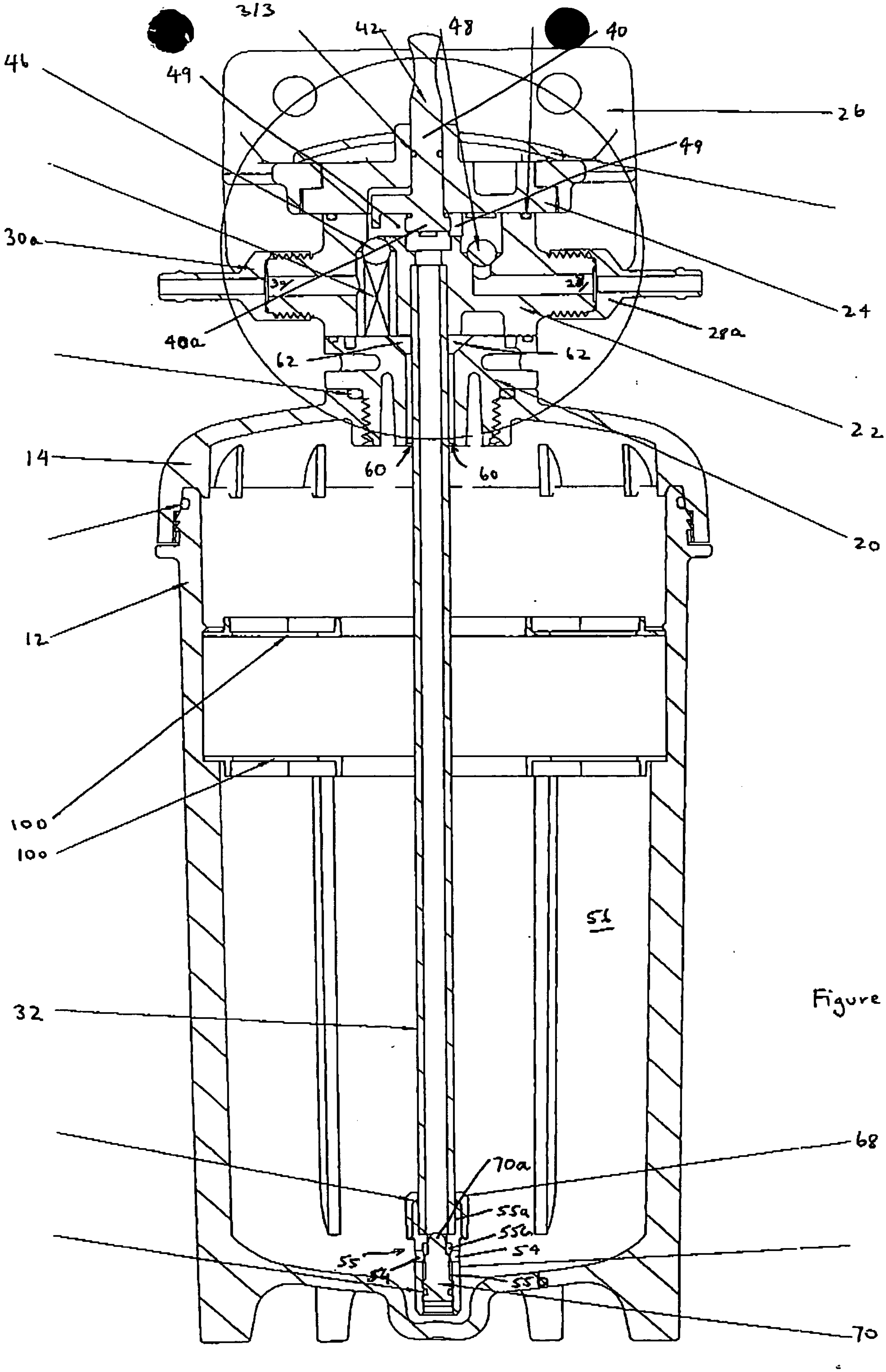
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Figure 3